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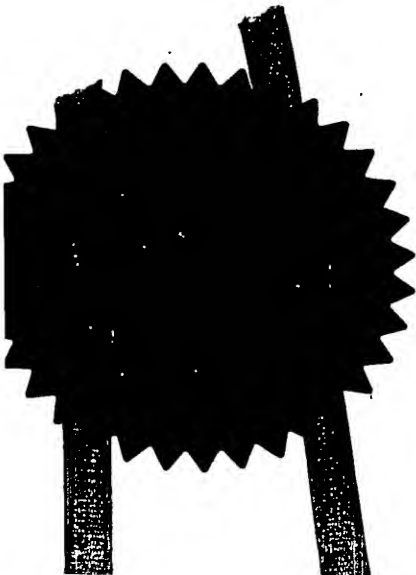
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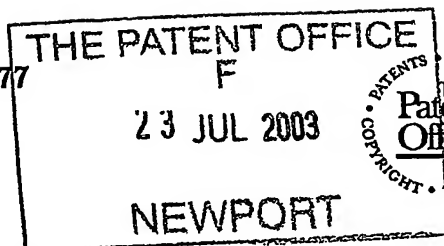
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2. Patent application number 0317183.2  
(The Patent Office will fill in this part) 23 JUL 2003
  
3. Full name, address and postcode of the or of each applicant (*underline all surnames*)  
  

Patents ADP number (*if you know it*)

If the applicant is a corporate body, give the country/state of its incorporation

Reckitt Benckiser (Australia) Pty Limited  
44 Wharf Road  
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Australia  
  
07954 431001  
  
Australia
  
4. Title of the invention Device for Enabling Vapour Emanation
  
5. Name of your agent (*if you have one*)  
  

"Address for service" in the United Kingdom to which all correspondence should be sent (*including the postcode*)

Patents ADP number (*if you know it*)

John Crawford McKNIGHT  
Reckitt Benckiser plc  
Group Patents Department  
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HU8 7DS  
United Kingdom  
  
07800 303001
  
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Country	Priority application number ( <i>if you know it</i> )	Date of filing (day / month / year)

  
7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing (day / month / year)

  
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I/We request the grant of a patent on the basis of this application.

Signature

John Crawford McKNIGHT

Date

18 July 2003

12. Name and daytime telephone number of person to contact in the United Kingdom

John Crawford McKNIGHT 01482 583719

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## **Device for Enabling Vapour Emanation**

### Field of the Invention

This invention relates to a device that enables the emanation of a chemical  
5 formulation, such as an insecticide or a fragrance, into surrounding atmosphere.

### Background to the Invention

A number of patent documents disclose portable devices that enable the  
application of a herbicide or an insecticide, particularly for the purpose of killing weeds  
10 and the like. Such an example is disclosed in US Patent No 4,309,842 in which a  
portable hand-held herbicide and insecticide applicator comprises a tube 12 which acts  
as a handle and connected at one end of the handle is a pair of hollow prong sections.  
The prong sections together with the handle 12 form a liquid reservoir conduit for the  
pesticide or herbicide and extending between the ends of the prong sections is an  
15 absorptive rope mop which is saturated with the liquid pesticide or herbicide. The user  
then drags the device over weeds and the like such that the saturated rope mop comes  
into contact with the weeds and thereby eventually kills the weeds.

Other devices include sprayer systems that have a reservoir and use an electric  
motor, such as is disclosed in US Patent No 6,109,548. This sprayer system reduces  
20 the need to manually create pressure within a portable spray unit. A valve stem within  
the reservoir may be utilised by a user to connect a conventional air tank thereto for  
inserting high amounts of air pressure directly into the reservoir without requiring the  
use of a manual or electric pump. Where a power switch is closed the electric motor  
operates the air compressor whenever the air pressure within the reservoir drops below  
25 a predetermined level. A manual pump may be utilised when the electric pump fails or  
a battery connected to the electric motor becomes discharged.

Other systems involve the atomisation of liquids, such as is disclosed in US  
Patent No 4,356,528. This patent discloses an invention that utilises electrostatic  
spraying of liquid compositions, particularly over leaves of plants, by supplying a  
30 liquid to a spray orifice, which is preferably of capillary dimensions. The spray orifice  
preferably has a charged surface which is electrically conducting or semi-conducting  
and which is adjacent a field intensifying electrode, the arrangement being such that the  
liquid is drawn out primarily by electrostatic forces, atomised into electrically charged  
particles and projected past the electrode. Thus the particles wrap around the leaves of  
35 the plants and coat both upper and lower surfaces of the leaves.

None of the above prior art systems provide a substantially low cost device that enables the discharge of a chemical formulation into surrounding atmosphere; particularly for the purpose of a personal insect repellent or in situations where a portable small apparatus may be used in a room which periodically enables the emanation or vaporisation of the chemical formulation. The present invention provides a device, such as in the form of a cartridge, that fits into a recess of a portable apparatus that enables such a periodic discharge of a chemical formulation. It may be refilled or replaced completely when all the chemical formulation has been discharged. There is a need for such an apparatus that is substantially low cost to run, may be run on batteries and last a substantial length of time without having to replace batteries or provide a new or refilled reservoir of the chemical formulation.

The present invention has substantial advantages over the above mentioned applicators and sprayers and conventional aerosol sprayers as there is no need for the user to physically operate the device as it may be left in an area, as a portable unit or a fixed unit depending on the power supply, to automatically enable discharge of a chemical vapour into a surrounding atmosphere.

#### Summary of the Invention

According to a first aspect of the invention there is provided a device for enabling a chemical formulation to be vaporized into an atmosphere comprising:

- means for storing the chemical formulation;
- wick means in continuous contact with the chemical formulation; wick support means for supporting the wick means;
- wherein the wick means is wet by the chemical formulation and upon contact with heater means vaporizes the chemical formulation.

The wick support means may be in the form of a containment means enclosing a substantial portion of the wick means. Preferably the containment means is constructed as a single article. Alternatively, the containment means is formed by a first portion and a second portion affixable to one another. Preferably the wick means is located between the first portion and the second portion of the containment means.

Preferably the wick means is substantially elongate having a first portion in continuous contact with the chemical formulation and a second portion in contact with the heater means. Preferably the heater means vapourizes the chemical formulation in the vicinity of the second portion of the wick means. Preferably the heater means is a

microheater element and particularly an impedance means such as a resistor.

Preferably the first portion of the device has an aperture in the vicinity of second portion of the wick means that contacts the heater means to enable the chemical formulation to vapourize into the atmosphere.

- 5        Preferably the second portion of the device has an aperture in the vicinity of second portion of the wick means that contacts the heater means to enable the chemical formulation to vapourize into the atmosphere.

Preferably the heater means has one or more pulses applied thereto in repeated fashion to provide heat in order to vapourize the chemical formulation.

- 10       Preferably the wick means has a resistance to flow of chemical formulation from the containment means sufficient to enable the second portion of the wick means to become wet after it has been dried by vapourization of the chemical formulation within a cycle of applied pulse or pulses to the heater means.

- Preferably the device is adapted to be received by portable apparatus having the  
 15 heater means, where the heater means is supplied with power from a portable power supply, such as batteries. Alternatively, the device may be adapted to be received by apparatus having heater means supplied with power from a fixed power supply, such as from a mains supply. Preferably the device has means to locate each of the first portion and second portion of the containment means such that the aperture of the first portion  
 20 is co-located with the heater means of the apparatus. Preferably the location means is a pair of indentations, one on each side of the containment means, that act in an interference fit with corresponding projections of the apparatus. This preferably provides a tactile indication to the user that the device is correctly located. Alternatively, the location means may be a pair of projections, one on each side of the  
 25 containment means, that act in an interference fit with corresponding indentations of the apparatus.

According to a second aspect of the invention there is provided a device for enabling a chemical formulation to be vapourized into an atmosphere comprising:

- 30       means for storing the chemical formulation;  
       wick means in continuous contact with the chemical formulation;  
       wick support means for supporting the wick means;  
       wherein the wick means is wet by the chemical formulation and, upon application of heat to the wet wick means, the chemical formulation is vapourized.

- 35       Preferably a portion of the wick means is exposed to the atmosphere. Preferably the exposed portion of the wick means is adjacent an aperture in the device.

Alternatively, the exposed portion of the wick means is one end or edge of the wick means.

#### Brief Description of the Drawings

5 Preferred embodiments of the invention will hereinafter be described, by way of example only, with reference to the accompanying drawings wherein:

Figure 1 illustrates a schematic view of separated components of a device according to the a first embodiment of the present invention;

Figure 2 is a top view of the device of Figure 1 shown fitted in an engaged  
10 position;

Figure 3 is a side sectional view taken through the device of Figure 1;

Figure 4 is a schematic view of a second embodiment of the device; and

Figure 5 is a schematic view of a third embodiment of the device.

#### 15 Detailed Description of the Preferred Embodiments

With reference to Figure 1 there is shown a device divided into its respective components, that enables a chemical formulation, such as an insecticide or a fragrance, to be delivered to a particular site via a wicking arrangement. Although the device shown in Figure 1 includes a first portion and second portion affixable to one another,  
20 it is to be noted that an alternative singular construction (one piece) for a wick support means may be used, such as a container made by an injection moulding process. Specifically there is shown a first portion 1, which is substantially planar and formed of a suitable material, such as PET (polyethylene terephthalate). The first portion 1 has a pair of indentations or notches 12 for the purposes of correctly locating the device and  
25 more particularly to locate an aperture 13 and aperture 7 over a heater means in the form of a microheater element 10 (see Figure 3). Each of the notches 12 are designed to interact with a corresponding pair of projections (or lugs) 15 formed in a housing into which this device fits in such a manner that the interaction between the lugs and the notches are an interference fit. This provides an indication to the user, in a tactile  
30 manner, that the devices are correctly engaged in the corresponding housing.

A second portion or top portion 5 is similarly made from PET and preferably has formed therein a blister or indentation 6 which forms a reservoir for housing the chemical formulation. The portion 5 similarly has an aperture 7 and indentations or notches 16 designed to interact with corresponding projections or lugs 17, in a similar  
35 interference fit to the notches and lugs associated with the base portion or first portion 1. Both the portions 1 and 5 are designed to be joined or sealed together by suitable

bonding means such as at 8 shown in Figures 2 and 3. Also shown in Figure 1 is a wick 4 that has a portion therein located within the body of the reservoir housing the chemical formulation and a portion co-located between the apertures 13 and 7 of the first portion 1 and second portion 5 respectively. Thus the wick 4 has one end portion 18, with reference to Figures 2 and 3, which is immersed, particularly, in a formulation such that the solid-liquid-vapour contact angle for the formulation, wick and air is  $0^\circ$ , and such that the wick 4 is completely wet out by the formulation, and a second end portion 19 that is in communication with the apertures 13 and 7 and a microheater element 10, such as a surface mount resistor. Preferably the wick is a thin flat absorbent material that is capable of wicking the active ingredient solution from the reservoir to the microheater element 10. It provides a sufficiently low lateral resistance to fluid flow such that the dried area of the wick in the vicinity of the portion 19 over the microheater element 10 is re-wet by the formulation in a time that is shorter than the pulse repetition cycle which delivers pulses to the microheater element 10. Such a pulse delivery arrangement is disclosed in a co-pending patent application to the same applicant. The wick 4 preferably has a sufficiently low transverse resistance to fluid flow such that the active ingredient held in the wick 4 can emanate as vapour from the top surface of the wick through aperture 7 by migration through the wick in accordance with the timing of the applied pulses to the microheater element 10. Thus the portion 19 of the wick must be able to be wet easily to enable sufficient vapour to be dispersed into the atmosphere by the application of a pulse or series of pulses to the microheater element 10 and be thereby replaced within the time of the arrival of the next pulse that supplies current to the microheater element 10.

The wick 4 must also be sufficiently thin so that the top surface of the wick can be heated sufficiently by the microheater element 10 in contact with the opposite or bottom surface. It generally is made of material that can withstand high temperatures generated by the microheater element 10 without disintegrating or decomposing. Furthermore it is made of a material having sufficient thermal insulation such that thermal energy transferred from the microheater element 10 heats a small part of the wick 4 to a high temperature in order to sufficiently vaporise the chemical formulation. Suitable materials that the wick may be made from include fine papers such as butcher's paper (80 microns thick), cigarette paper (30 microns thick), or fine silk or cotton cloth (less than or equal to 100 microns in thickness) in order to achieve a sufficiently high efficiency (mg/J) for long battery life. The arrangement that supplies pulses to the microheater element 10 has power provided by a series of batteries.



The apertures 13 and 7 are primarily designed, as is clearly shown in Figure 3, to be co-located over the microheater element 10 whereby the wick 4 which is in contact with the microheater element 10 is able to disperse the active ingredient of the chemical formulation through the apertures into the surrounding atmosphere. As is shown in this figure, the sealing regions 8 in the top and bottom portions 1 and 5 are joined to each other directly to form an impermeable seal. Alternatively the top and bottom surfaces of the wick 4 may be joined to the respective surfaces of the first portion 1 and second portion 5.

The container forming the reservoir 6 for the chemical formulation preferably holds a volume of active ingredient of chemical formulation that allows suitable duration of performance, preferably one to two millilitres that will last for a few weeks to a month. It is to be understood that other volume magnitudes of active ingredients of the chemical formulation are possible depending on the particular circumstances. For example, a lower limit of volume may be as low as 20 microlitres as a consequence of the potency or concentration of the active ingredient used. The end portion of the wick 18 and a substantial portion of the wick is in fact in contact with the chemical formulation in the reservoir 6 at all times and in all orientations. At the other end 19 of the wick 4 it is exposed to the atmosphere through the respective apertures 13 and 7 and is in contact with the microheater element 10 that allows the emanation of the chemical formulation into the surrounding atmosphere from either or both the surfaces of the wick 4. It is noted at a portion 20 of the reservoir 6 the first and second portions 1 and 5 are bonded but still allow protrusion of the wick 4 to the atmosphere. The overall device, including the first portion 1 and second portion 5 holds the wick 4 with sufficient rigidity so that the exposed wick portions can be located with precision onto the microheater element 10. The form factor of the device must engage with the mounting points, that is through the interference fit between the lugs and notches, such that the wick 4 is correctly located in relation to the microheater element 10. Tactile feedback is provided to the user when the device is correctly engaged within a respective housing that may be a bump, as an example, to indicate that it is correctly fitted. The reservoir is preferably transparent or translucent so that the user can see how much chemical formulation is remaining and replace the reservoir when empty. The particular reservoir may be refilled or optionally the whole device with a new reservoir may be used and fitted into the apparatus housing the microheater element 10 and a power management circuit in accordance a the copending patent application to the same applicant.

Shown in Figure 4 is another embodiment of the invention, wherein as with the embodiments shown in Figures 1 to 3, the wick 4 is located between portions 1 and 5. The device in Figure 4 has no indentations adapted to interference fit with corresponding projections but may be inserted into a receptacle which is heated by a heating device. Only the aperture 7 existing in the second or top portion 5 exists which lies above end 19 of the wick 4. However, the aperture 7 may exist in only the first portion 1 in contact with end 19 of the wick 4. The other end 18 of wick 4 is in continuous contact with the chemical formulation in reservoir 6. The wick 4 is thereby wet by the chemical formulation such that the chemical formulation travels along the wick 4 through the sealed region 21 between the reservoir 6 and the top portion 5 towards the end 19 whereby the region of the device enclosed by the dotted line 22 is heated such that the chemical formulation vapourizes and emanates through aperture 7 into the surrounding atmosphere. Thus the reservoir 6 containing the chemical formulation is not heated by the particular heating device.

With reference to Figure 5 there is shown a further embodiment in which the wick 4 is mounted transversely across the longitudinal axis of the reservoir 6 and top portion 5. The edges 23 and 24 of the wick 4 are respectively mounted flush with corresponding edges 25 and 26 of the top portion 5 (and lower portion 1). However, the edges 23 and 24 remain exposed to the atmosphere whereas the remainder of the edges 25 and 26 of the top portion 5 remain sealed to the corresponding lower portion 1 of the device. The portions of the wick 4 exterior to the reservoir 6 apart from the edges 23 and 24 are also sealed so that no chemical formulation emanates from these areas but only through edges 23 and 24. Thus when heat is applied to the region enclosed by the dotted line 27, the chemical formulation in reservoir 6 having wet the wick 4 and subsequently moved to the edges 23 and 24, vapourizes to the surrounding atmosphere through edges 23 and 24 of the wick 4.

In a further embodiment, the wick 4 may be wholly enclosed or surrounded by the chemical formulation in the reservoir but defining a boundary or partition between the reservoir and the wick 4. The wick 4 may be supported by a wick support having such a boundary or partition preferably to keep the wick substantially rigid. Such a support and partition may be made from suitable materials such as plastic or PET. At one or more locations along the partition or boundary, the wick 4 is not sealed from the reservoir 6. Thus at those particular locations the wick 4 is wet by the chemical formulation. An aperture may be located on one or both sides of the device in communication with the wick 4 such that on heating the whole device (in the region of the wick 4 and the reservoir 6) the chemical formulation emanates through the aperture

and is vapourized to the surrounding atmosphere. One particular arrangement of this embodiment is a wick in the shape of a star where the points of the star are in contact with the chemical formulation and define a substantially circular boundary between the star-shaped wick and the reservoir of the chemical formulation. At the centre of the star is an aperture through which the chemical formulation is vapourized upon application of heat.

Thus in use the device in accordance with the embodiment described with reference to Figures 1 to 3, having a reservoir full of chemical formulation such as insecticide or a fragrance, is inserted into an opening of a corresponding apparatus, which may be portable or fixed depending on the power supply to the heater means, such that the user has tactile feedback via the interference fit between the notches 12 and 16 and the lugs 2 and 17 respectively. This indicates to the user that the apertures 7 and 13 are correctly located in substantially the same plane above the microheater element 10. The apparatus is then free for use by the user in any particular application whether as a personal device, or to be left in a room for example into which the chemical formulation is vaporised.

Using the device in accordance with the embodiments of Figures 4 and 5 or in relation to the embodiment using the star-shaped wick, the device may be inserted into a receptacle having a heating means and be heated at various intervals until the chemical formulation in the reservoir 6 is fully depleted.

It will be appreciated by persons skilled in the art that numerous variations and/or modifications may be made to the invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive.

## CLAIMS:

1. A device for enabling a chemical formulation to be vaporized into an atmosphere comprising:
  - 5 means for storing the chemical formulation;
  - wick means in continuous contact with the chemical formulation;
  - wick support means for supporting the wick means;
  - wherein the wick means is wet by the chemical formulation and upon contact with heater means vaporizes the chemical formulation.
- 10 2. A device according to claim 1 wherein the wick support means is a containment means enclosing a substantial portion of the wick means.
3. A device according to claim 2 wherein the containment means is formed by a  
15 first portion and a second portion affixable to one another.
4. A device according to claim 3 wherein the wick means is located between the first portion and the second portion of the containment means.
- 20 5. A device according to claim 4 wherein the storage means is located on the second portion of the containment means.
6. A device according to claim 1 wherein the wick means is substantially elongate having a first portion in continuous contact with the chemical formulation and a second  
25 portion in contact with the heater means.
7. A device according to claim 6 wherein the heater means vapourizes the chemical formulation in the vicinity of the second portion of the wick means.
- 30 8. A device according to claim 7 wherein the first portion of the containment means has an aperture in the vicinity of second portion of the wick means that contacts the heater means to enable the chemical formulation to vapourize into the atmosphere.
9. A device according to claim 7 or claim 8 wherein the second portion of the  
35 containment means has an aperture in the vicinity of second portion of the wick means

that contacts the heater means to enable the chemical formulation to vapourize into the atmosphere.

10. A device according to any one of claims 7 to 9 wherein the heater means has one or more pulses applied thereto in repeated fashion to provide heat in order to vapourize the chemical formulation.

11. A device according to claim 10 wherein the wick means has a resistance to flow of chemical formulation from the chemical formulation storage means sufficient to enable the second portion of the wick means to become wet after it has been dried by vapourization of the chemical formulation within a cycle of applied pulse or pulses to the heater means.

12. A device according to claim 11 adapted to be received by portable apparatus having the heater means, the heater means being supplied with power from a portable power supply.

13. A device according to claim 11 adapted to be received by apparatus having the heater means, the heater means being supplied with power from a mains power supply.

14. A device according to claim 12 or claim 13 having means to locate each of the first portion and second portion of the containment means such that the aperture of the first portion of the containment means is co-located with the heater means.

15. A device according to claim 14 wherein the location means is a pair of indentations, one on each side of the containment means, that act in an interference fit with corresponding projections on the apparatus, which when engaged provide an indication to a user that the device is correctly located with respect to the apparatus.

16. A device according to claim 14 wherein the location means is a pair of projections, one on each side of the containment means, that act in an interference fit with corresponding indentations on the apparatus, which when engaged provide an indication to a user that the device is correctly located with respect to the apparatus.

17. A device for enabling a chemical formulation to be vapourized into an atmosphere comprising:

means for storing the chemical formulation;

wick means in continuous contact with the chemical formulation;

wick support means for supporting the wick means;

wherein the wick means is wet by the chemical formulation and, upon  
5 application of heat to the wet wick means, the chemical formulation is vapourized.

18. A device according to claim 17 wherein a portion of the wicks means is exposed  
to the atmosphere.

10 19. A device according to claim 18 wherein the exposed portion of the wick means  
is adjacent an aperture means in the device.

20. A device according to claim 18 wherein the exposed portion of the wick means  
is one end or edge of the wick means.

15

21. A device according to any one claims 17 to 20 wherein the whole device has  
heat applied thereto in order to vapourize the chemical formulation.

22. A device according to any one of claims 18 to 20 wherein the exposed portion  
20 of the wick means has heat applied thereto in order to vapourize the chemical  
formulation.

23. A device according to any one of claims 17 to 22 wherein the wick support  
means is a containment means enclosing a substantial portion of the wick means.

25

24. A device according to claim 23 wherein the containment means is formed by a  
first portion and a second portion affixable to one another.

25. A device according to claim 24 wherein the wick means is located between the  
30 first portion and the second portion of the containment means.

26. A device according to claim 25 wherein the storage means is located on the  
second portion of the containment means.

35 27. A device according to claim 26 wherein the wick means is substantially  
elongate having a first portion in continuous contact with the chemical formulation and

a second portion in contact with the aperture means, said aperture means located in one of either the first portion or second portion of the containment means.

28. A device according to claim 26 wherein the wick means is located substantially  
5 transverse to the containment means and storage means.

29. A device according to claim 28 wherein the wick means is substantially planar and has a first edge mounted flush with a corresponding first edge of each of the first and second portions of the containment means.

10

30. A device according to claim 29 wherein the first edge of the wick means is exposed to the atmosphere.

31. A device according to claim 29 or claim 30 wherein the wick means has a  
15 second edge mounted flush with a corresponding second edge of each of the first and second portions of the containment means.

32. A device according to claim 31 wherein the second edge of the wick means is exposed to the atmosphere.

20

33. A device according to any one of claims 17 to 19 wherein the wicks means is located in and separated by a partition from the chemical formulation storage means.

34. A device according to claim 33 wherein one or more parts of the wick means is  
25 in contact with the chemical formulation storage means across the partition in order to allow the wick means to be wet by the chemical formulation.

**ABSTRACT:****Device for Enabling Vapour Emanation**

- 5 A device for enabling a chemical formulation to be vapourized into an atmosphere having means (6) for storing the chemical formulation, wick means (4) in continuous contact with the chemical formulation, wick support means (1,5), wherein the wick means (4) is wet by the chemical formulation and upon contact with a heater means (10) or having heat applied to the wick means (4), the chemical formulation is
- 10 vapourized.



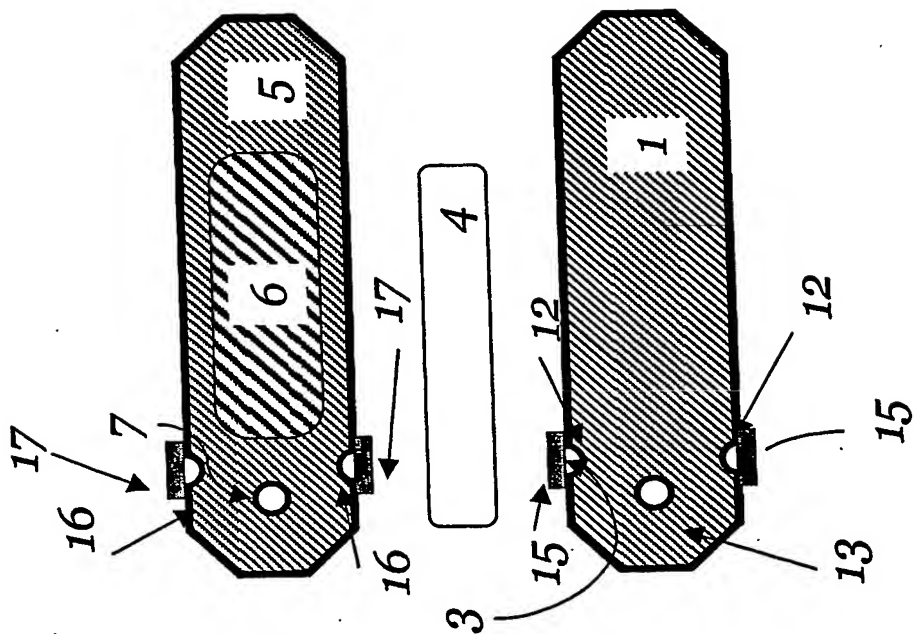


Figure 1

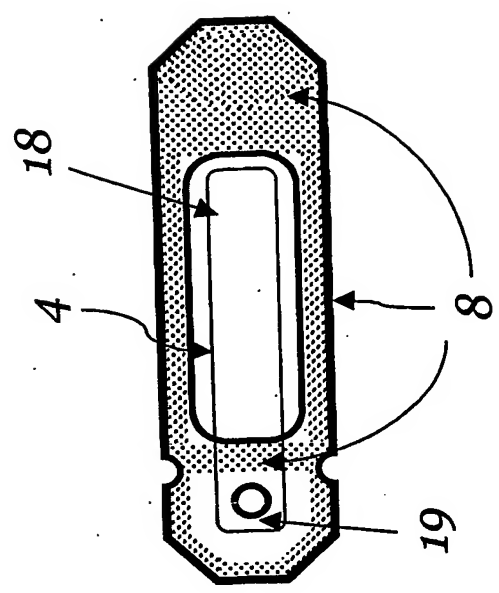


Figure 2

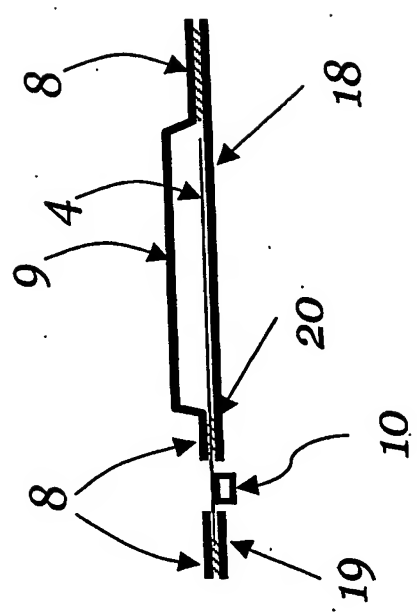


Figure 3

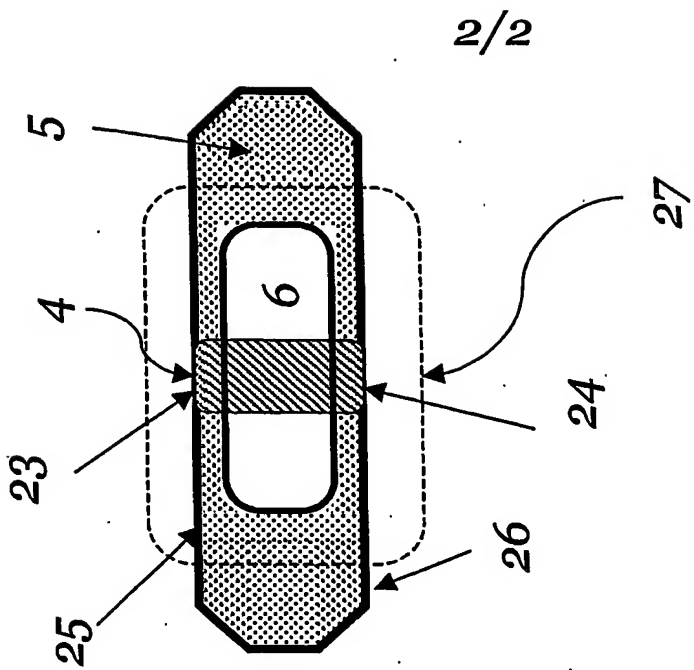


Figure 5

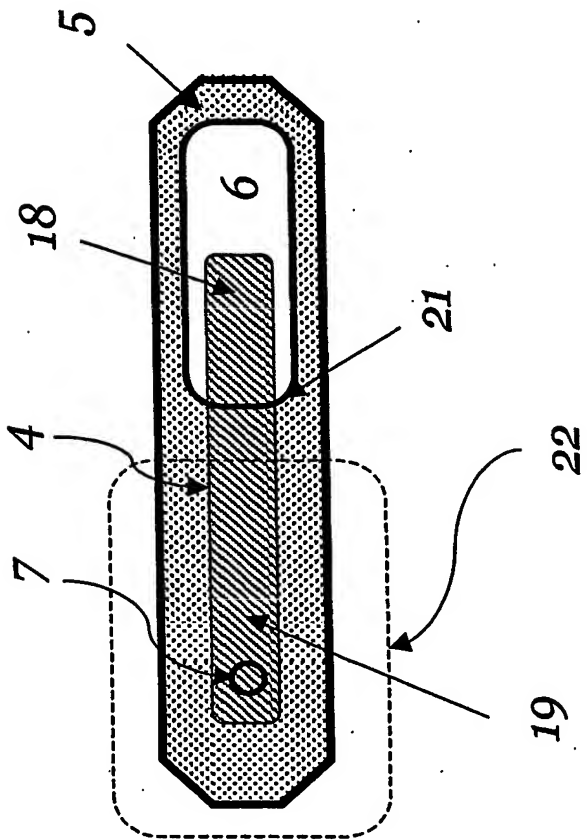


Figure 4

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